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Southern Appalachian Salamanders: An Indexed Bibliography

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SOUTHERN APPALACHIAN SALAMANDERS:

AN INDEXED BIBLIOGRAPHY

by Raymond C. Mathews, Jr.

NATIONAL PARK SERVICE - Southeast Region

Research/Resources Management Report SER-79

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INTRODUCTION

The great diversity and abundance of salamanders in Great Smoky Mountains National Park (GRSM) are unsurpassed in any other area of the world (Table 1) and thus represent a unique and important natural resource. The Southern Appalachian region, with its diverse and heavily forested mountains, humid-mesothermal climate, and numerous fast-flowing, highly oxygenated streams, represents a habitat highly suited to the life cycles of salamanders.

The plethodontid (lungless) salamanders, in particular, make up the largest family of salamanders in the eastern United States. They are located mainly in the Southern Appalachians, which is generally accepted as their place of origin and dispersal (Dunn 1926, Hairston 1949, Martin and Harrell 1957). Huheey and Stupka (1967) developed a comprehensive field guide for the salamanders of GRSM which is now generally considered outdated.

Because of the importance of salamanders to the park and the importance of herpetological research here, this bibliography on salamanders was developed as part of the Great Smoky Mountains Bibliographical Project[1]. The goal of this indexed bibliography is to provide a rapidly accessible reference source of published material relevant to salamander research in GRSM and make it readily available to interested researchers and naturalists. Some unpublished theses, abstracts, and technical reports are also included.

Primary emphasis is on salamander research conducted in GRSM in North Carolina and Tennessee, but other studies conducted outside GRSM are directly applicable and are included in this bibliography. The perspective was therefore enlarged to include all of the Southern Appalachians. For the purposes of this bibliography, the Southern Appalachian region is defined to encompass the following areas:

(1) Unakas, Great Smoky Mountains, Blue Ridge, Blue Ridge escarpment, Black Mountains, Grandfather Mountain, Nantahala Mountains, and the Unicois, or

(2) A general area bounded by the following: mountains about 10 miles south of Wyethville and Marion, VA; west of Grayson and Old Town, VA; about 5 miles northwest of Rutherfordton, NC; including Pickens, SC, Madison, SC, and Clarkesville, GA; including Dalton, GA, and Reliance, TN; east of Madisonville, Sevierville, and Johnson City, TN.

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[1] Pyle, C., and P. S. White. 1979. Coding of written material relating to research done in Great Smoky Mountains National Park. USDI, National Park Service, Uplands Field Research Laboratory, Gatlinburg, TN. 9 p.

TABLE 1. SALAMANDERS OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK.

Family	*Complex/Genus Species/Subspecies	Common Name
Cryptobranchidae	Aquatic Large Bodied Salamanders/ Genus *Cryptobranchus*	
	Cryptobranchus allegansiensis	Hellbender
Necturidae	Permanent Aquatic Larvae/Genus *Necturus*	
	Necturus m. maculosus	Mudpuppy
Ambystomidae	Mole Salamanders/Genus *Ambystoma*	
	Ambystoma opacum	Marbled Salamander
	Ambystoma maculatum	Spotted Salamander
Salamandridae	Newts/Genus *Notophthalmus*	
	Notophthalmus v. viridescens	Red-spotted Newt
Plethodontidae	Dusky Salamanders/Genus *Desmognathus*	
	Desmognathus ochrophaeus	Blue Ridge Mountain Salamander
	Desmognathus m. monticola	Appalachian Seal Salamander
	Desmognathus quadramaculatus	Black-bellied Salamander
	Desmognathus wrighti	Pigmy Salamander
	******Desmognathus santeetlah*	Santeetlah Salamander
	Desmognathus imitator	Imitator Salamander
	Leurognathus marmoratus	Shovel-nosed Salamander
	Woodland Salamanders/Genus *Plethodon*	
	Plethodon d. dorsalis	Zigzag Salamander
	Plethodon g. glutinosus	Slimy Salamander
	†*Plethodon j. jordani*	Red-cheeked Salamander
	Plethodon jordani metcalfi	Metcalf's Salamander

TABLE 1. (cont.)

Family	*Complex/Genus Species/Subspecies	Common Name
	Hemidactylium scutatum	Four-toed Salamander
	Gyrinophilus porphyriticus danielsi	Blue Ridge Spring Salamander
	††Aneides aeneus	Green Salamander
Mud and Red Salamanders/Genus Pseudotriton		
	Pseudotriton montanus diasticus	Midland Mud Salamander
	Pseudotriton ruben schencki	Black-chinned Red Salamander
Brook Salamanders/Genus Eurycea		
	Eurycea bislineata wilderae	Blue Ridge Two-lined Salamander
	Eurycea longicauda guttolineata	Three-lined Salamander
	Eurycea l. longicauda	Long-tailed Salamander

*Complex name which delineates between groups of salamanders of the same genus having certain common characteristics.

**See S. G. Tilley. 1981. A new species of Desmognathus from the Southern Appalachian Mountains. Occasional papers of the Museum of Zoology, Univ. Michigan No. 695:1-23.

†Plethodon j. jordani and Plethodon jordani metcalfi were grouped as one species, Plethodon jordani, Appalachian Woodland Salamander, by Conant (1975) in his second edition of A Field Guide to Reptiles and Amphibians of Eastern and Central North America, since he considered the many subspecific varieties a highly variable array of one wide-ranging species with numerous color morphs.

††Record of occurrence in the park based on only one collection record by R. Dary in 1929 (Weller 1931), and repeated searches have never resulted in subsequent collections.

Some papers deemed important to the understanding of Southern Appalachian salamanders were included, even if they covered areas outside the region. Other studies cited are based on worldwide analyses of salamanders that refer to the Southern Appalachians as only a small segment of their perspective. Hence, the bibliography contains references to Southern Appalachian taxa even if the work was entirely or primarily based outside this region.

A number of works are cited which are treatments of salamanders as a whole--they are included for their detail on general biology and specific information on various salamander families and species found in GRSM (e.g., G. K. Noble 1954, C. J. Goin and O. B. Goin 1962 and 1971, S. C. Bishop 1962, K. R. Porter 1972, E. R. Dunn 1926, C. K. Dodd 1977a). A number of salamander check-lists (e.g., Schmidt 1953) and field guides (e.g., Zim and Smith 1956, Bishop 1941, Conant 1958 and 1975) representing the Southern Appalachian region and GRSM as part of their context have thus been included.

The bibliography, because of the thrust of the research conducted in past years, is dominated by field-oriented salamander studies. Many of these provide the basis for future studies in specific areas or localities. They also represent baseline ecological, distributional, and population information for the taxa of this region. In addition, many works on the identification and systematics of salamanders are also cited. The literature on ecological structure and composition in Southern Appalachian habitats, in particular, is extensive. It contains much information on salamander occurrence and distribution. References for laboratory-oriented research in genetics, physiology, anatomy, and morphology, etc., are somewhat limited, but such research has increased considerably during the past several years.

A separate unabridged accomplishment of this bibliographic effort has been the development of a computer-facilitated cross-referencable bibliography. Pyle and White (1979)[1] provide a general format for cross-referencing all the bibliographic projects. The computer-formated portion of the salamander bibliography includes these generalized cross-reference categories and the computer routines specific to the various areas involved in salamander research, which are helpful in accessing such information (Mathews and Pyle 1982[2], Pyle and Mathews 1980[3]).

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[2]Mathews, R. C., Jr., and C. Pyle. 1982. Southern Appalachian salamanders: a computerized cross-indexed bibliography, 1895-1980. Technical Rep., Uplands Field Research Laboratory, Great Smoky Mountains National Park, Gatlinburg, TN. 115 p.

[3]Pyle, C., and R. C. Mathews, Jr. 1980. Great Smoky Mountains National Park Natural History Association Scientific Information Project: Coding system for salamander collections from Great Smoky Mountains National Park, USDI, National Park Service, Uplands Field Research Laboratory, Gatlinburg, TN. 24 p.

METHODS

The bibliographic search was conducted at GRSM and the University of Tennessee at Knoxville (UTK). At GRSM the park archives and library were searched, and additional references were retrieved from my personal research files. At UTK, theses and journals were searched article by article--in particular, Copeia, Herpetologica, Journal of the Elisha Mitchell Science Society, American Midland Naturalist, Journal of Herpetology, Ecology, Ecological Monograms, and Evolution. The UTK now has a computer-aided search facility, and use of key words such as Salamanders, GRSM, Southern Appalachians, etc., are suggested for further investigation.

UNPUBLISHED INFORMATION SOURCES

In conjunction with the literature search, the GRSM archives were also an important source of pertinent information (e.g., field notes, correspondence) on salamanders that has never been published. Important unpublished archival information at GRSM included the journals of Arthur Stupka (Park Naturalist/Park Biologist), the field notes of Willis King (GRSM Park Technician/USFWS Biologist), and miscellaneous correspondence and manuscripts of university researchers and park naturalists. These are included in the bibliography. Other descriptive information on salamander research in GRSM not included in the bibliography is available from the collecting permit files (Resource Management Division, GRSM); the Investigator's Annual Reports (Office of the Superintendent, GRSM); wildlife observation records for GRSM (maintained by the Division of Interpretation, GRSM); and the park library at Sugarlands Visitor Center. Finally, abstracts from the annual science meetings at GRSM, published by the National Park Service's Southeast Regional Office, contain reports of salamander research currently ongoing in GRSM and the surrounding area and often provide important information on research findings that are not published in journals for a long time afterwards. Therefore, several of these abstracts are included in the bibliography, along with those from The Highlands Conference on Plethodontid Salamanders (Highlands Biological Station, Highlands, NC, August 7-10, 1982).

Collection records of salamanders from GRSM and the Southern Appalachians were also obtained from the University of Maryland Department of Zoology (Herpetologist, Dr. R. Highton); Smith College, Department of Biological Sciences (Herpetologist Dr. S. G. Tilley); and the University of Tennessee, Department of Zoology (Curator, Dr. A. C. Echternacht). Dr. Tilley donates

all his collections after analyses to the U. S. National Museum, Smithsonian Institute, Washington, DC. The early collections made in GRSM by Willis King, Arthur Stupka, and others between 1934 and 1959 were formerly maintained at the Uplands Field Research Laboratory, GRSM until 1982. These collections are presently maintained at UTK, Department of Zoology. Some unpublished reports and important collection records are included in the bibliography.

An editorial decision was made not to include the majority of these unpublished information sources as part of the bibliography because of the immensity of their numbers and resulting detraction from published works. Only those of historic value or those considered to be of an important nature were included. It is important to note that these unpublished sources of information are available in the locations previously described and may be of assistance to researchers.

SUMMARY

Salamanders occupy GRSM and the Southern Appalachians within every conceivable microhabitat available. The complexity of their distribution is reflected in the literature given in this bibliography. Patterns of abundance and biomass distribution are becoming evident after many years of intense research. Distributional aspects of salamander research has been the primary focus in the Southern Appalachians. Genetic differentiation of salamander species through electrophoretic analyses has recently improved our understanding of evolutionary processes, systematic discrimination, and phylogenetic development.

Habitat complexity and environmental variables reportedly affect species diversity and distributions of salamanders, according to recent published material. Gradients of salamander diversity, abundance, and biomass in relation to soil moisture, understory vegetation, forest type, temperature, stream size, logging history, and precipitation, among other environmental variables, have been discussed extensively in recent literature. The geographic variation in salamander populations and communities in the Southern Appalachians is complex and probably affected as much by environmental and habitat elements as by competition. Evolutionary theory as it applies to interspecific competition holds that ecologically equivalent species in contact will evolve to become different by an amount specified by their positions on the resource spectrum. In recent years, considerable research has been oriented towards distributional relationships in different ranges of the Southern Appalachian Mountains, where intense competition causes changes in the zone of horizontal and vertical overlap of their ranges (i.e., narrow in some habitats, broad in others).

A long history of research (135 years) on the salamanders of this area has provided a unique level of understanding of these organisms, although their complexity leaves many research challenges ahead. About one-third of the citations come from work done during the past five years (Table 2). Many of the challenges ahead include those in the area of environmental impacts resulting from acid precipitation, roadcut chemistry, forest cover transitions due to parasitism, European wild hog rooting, and even research collecting and translocation. Our environment is experiencing numerous anthropogenic impacts that are changing the natural distribution, diversity levels, and population trends to those structured by man's activities. The value of past research findings is much enhanced as a result of these environmental changes, and the relationship to resource management for mitigation of these impacts is of timely importance if we are to preserve a portion of this biosphere.

TABLE 2. FREQUENCY OF CITATIONS BY YEAR.

YEARS OF PUBLICATION	NUMBER OF CITATIONS
1850-1900	1
1920-1929	5
1930-1939	11
1940-1949	21
1950-1959	31
1960-1969	38
1970-1979	101
1980-1985	102
TOTAL 135 Years	310

The author of this bibliography was formerly a research biologist (1977-1982) with the Uplands Field Research Laboratory (GRSM), and presently is employed by an environmental consultant company at the following address:

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(214) 423-5480

I will do my best to answer any questions and give assistance to researchers studying salamanders in the Southern Appalachian Mountains, and particularly in GRSM.

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Dodd 1977(a), Dunson and Connell 1982, Freda and Dunson 1984, Mathews 1982(a), Mathews and Larson 1978, 1980, Mathews and Phillips 1982, Pierce 1985, Tome and Pough 1982.

BEHAVIORAL ECOLOGY:
Brandon and Huheey 1975, Dodd and Brodie 1976, Hairston 1976, Jaeger 1982, Keen 1979, Keen 1982, Wood 1951

BIRDS:
Brandon and Huheey 1975, Brodie 1982, Brodie and Howard 1973, Bury et al. 1980, Dood et al. 1974, Hensel 1974, Howard and Brodie 1970, 1973, Huheey 1960, King 1935-1938, Stupka 1935-1963

BREEDING MIGRATIONS:
Hardy and Raymond 1980, Krzysik 1980(a), Lotter 1978, Noble 1954, Thompson et al. 1980, Wake 1980

BURROWING HABITAT:
Brook 1946, Huheey 1959, Huheey 1964, Noble 1954, Porter 1972, Trauth 1977

CAVES:
Huheey and Brandon 1961(a), Hutchison 1956, Hutchison 1958, Mathews 1981, Mathews et al. 1976, Merkle and Guttman 1977

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Ashton and Ashton 1978, Hall 1976, Heatwole 1962, Holman 1976, Larson et al. 1980, Mathews 1982(a), 1984, Mathews and Larson 1980, McClure 1931, Petranka 1979, Trauth 1977

COLLECTION RECORDS/FIELD SIGHTING NOTES:
Anonymous 1959(a), Anonymous 1959(b), Brimley 1927, Cochran 1961, Highton and Grobman 1956, Huheey and Stupka 1965, King 1935-1938, 1935-1970, 1936, 1939, 1944, Mairs 1965, Mittleman 1946, 1948, Mittleman and Jopson 1941, Pope 1928, Pyle and Mathews 1980, Reese 1950, Schenck 1979, Schmidt 1953, Sever 1976, Society for the Study of Amphibians and Reptiles 1963-1970, Stupka 1935-1963, Tilley 1973, 1981, Walker 1931, Weller 1931, Williams et al. 1981, Windsor 1931, 1932, Wood 1947(c), 1949

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Grobman 1944, Hensel 1974, Highton 1959, Howard and Brodie 1970, 1971, 1973, Huheey 1960, 1961, 1966(a); 1966(b), 1966(c), Huheey and Brandon 1961(b), 1974, Labinick and Brandon 1981, Lotter 1977, Pfingsten and Walker 1948, Reynolds 1961, Tilley 1969.

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Bruce 1982, Fraser 1976, Hairston 1951, 1979(a), 1979(b), 1980, 1981, 1983, Jaeger 1970, 1971(a), Labanick and Brandon 1981, Pauley 1978, Reinbold 1979, Seale 1980, Wilbur 1972, Wrobel et al. 1980

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DIURNAL ACTIVITY:

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ENDANGERED AND THREATENED:

Carpenter 1982, Dodd 1979, Mathews 1981, Mathews and Echternacht 1984, Porter 1972, White, 1985.

ENVIRONMENTAL IMPACTS:

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FOREST TYPE:

Bennett et al. 1980, Bury 1983, Fraser 1976, Heatwole 1962, Huheey and Brandon 1974, Johnson and Schad 1959, King 1936, 1939, Madison 1969, Mathews 1984, Mathews and Echternacht 1984, McClure 1931, Singer et al. 1981, 1982, Taub 1961, White 1985, Wood and Wood 1955.

GEOGRAPHIC VARIATION:

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REDUCTION/COURTSHIP:

Brooks 1948, Bruce 1969, 1975, 1978(c), Dodd and Brodie 1976, Forester 1979, Goin and Goin 1971, Goodwin and Wood 1953, Hairston 1983, Highton and Savage 1961, Houck and Arnold 1982, Houck et al. 1982, Keen and Orr 1980, Krzysik 1980(a), 1980(b), Lotter 1978, Montague and Poinski 1978, Noble 1954, Organ and Lowenthal 1963, Porter 1972, Sever 1978(a), 1978(b), 1979, 1980, 1981, Taylor and Guttman 1977, Thompson et al. 1980, Tilley 1970, 1972, 1973, Tilley and Tinkle 1968, Wake 1980, Wilbur and Collins 1973, Wood 1953(a), 1953(b), 1955, Wood and McCutcheon 1954, Wood and Rageot 1955, Wood and Wilkinson 1952, Wood et al. 1955.

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Abernathy et al. 1984, Kryzsik 1980, Larson et al. 1980, Taub 1961, Trauth 1977.

SPIDERS:

Huheey and Stupka 1967, Johnston and Schad 1959

SPRING SEEP:

Dodd 1977(a), Hairston 1947, Hutchison 1956, Wood 1951.

STREAM HABITAT:

Danstedt 1975, Dodd 1977(a), Hairston 1947, Hedrick and Mathews 1978, Huheey 1966(a), 1966(b), Keen 1982, Larson and Hammitt 1981, Mathews 1976, 1978, 1982(b), Mathews and Larson 1980, Mathews and Morgan 1982, Noeske and Nickerson 1979, Petranka 1983, Pope 1928, Porter 1972, Tilley 1971, Williams et al. 1981, Wood 1951, 1953(a), 1953(b).

SYSTEMATICS:

Caldwell and Trauth 1979, Grobman 1941, Hairston 1982, Highton 1960(a), 1960(b), 1962(b), King 1936, Maxson 1982, Noble 1954, Pope 1928, Porter 1972, Reese 1950, Sever 1976, Society for the Study of Amphibians and Reptiles 1963-1970, Tiller 1981, Tilley and Schwerdfeger 1981, Tilley et al. 1978, Wood 1947(a), 1947(b).

TERRESTRIAL HABITAT:

Anderson 1976, Bennett et al. 1980, Dodd 1977, Heatwole 1962, Heatwole and Lim 1961, Huheey 1966, Huheey and Brandon 1967, 1973, Jaeger 1970, 1971(a), 1971(b), King 1939, McClure 1931, Porter 1972.

VISITOR IMPACT:

Bratton et al. 1980, Larson and Hammitt 1981, Carpenter 1982, Stupka 1935-1963.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environment and cultural value of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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